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PAST AND PRESENT FLORAL CONDITIONS IN CENTRAL MASSACHUSETTS.

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IN an area like Massachusetts, which is thickly populated, and which has been settled for over two hundred years, an area in which the agricultural industries have changed to that of manufacturing, and in which the forest growths have been removed a number of times, we have an opportunity to study the methods of deforestation which have prevailed in New England from its earliest settlement, and the effects of these methods upon the floral conditions.

The tree growths of central Massachusetts differ from those of other parts of the state only in so far as climate and soil peculiarities are concerned. The characteristic forest trees in this locality are the pine, chestnut, oak, and birch. The pine and chestnut are especially adapted to this region, as is shown by their great abundance, both of these being more common in central Massachusetts than in any other portion of the state. The pine is especially abundant here, because of the fact that it can adapt itself to a great variety of conditions.

The historical records of our forests date back as far as 1634, in fact, to the time of the early settlements in New England. They show, on the whole, that the climatic conditions have probably not changed very much, though undoubtedly local effects have been brought about by the removal of the forests, and also from industrial activities.

Excepting two mountains about two thousand feet high, the central portion of Massachusetts has an average elevation of one thousand feet, which gradually descends on the eastern and western border to one of about three hundred or four hundred feet. Of the species which thrive better on the higher elevation may be mentioned the red spruce, mountain maple, striped maple, mountain ash, beech, canoe birch and

mountain laurel. The latter reaches its height of perfection here, while on the other hand, this elevation not infrequently gives rise to stunted growths in certain species. Geologically this region is composed largely of gneiss, with limited areas of mica schist, over which is spread sand and clay, deposited in various combinations. The sand is more common in the eastern than in the western portion, a fact which holds good throughout the whole state, as does also the per cent of chlorine which the soil contains, and this, just as might be expected, exerts a modifying influence on the flora. Passing northerly and southerly along the central ridge are numerous lenticular clay hills, known as drumlins, which once supported a marked characteristic growth. The hills, for many reasons, were among the first lands to be utilized, and they constitute the best agricultural soil to-day. They were early cleared of their forests, so that it is at present difficult to find any of them completely covered with tree growth. The English settlers, in choosing these hills, simply followed to a certain extent in the footsteps of the Indians, inasmuch as they had cleared quite a number before the advent of the white man. The characteristic growth upon these hills is and always has been, of hard wood of such species as the chestnut and oak. When, however, there is a superficial deposit of sand, as is sometimes the case, they give rise to pine and other species. No less characteristic are the species found on the gravelly ridges known as kames or eskars. They support to-day, as of old, a growth of pitch pine, scrub oak, chinquapin oak and white birch. These trees are peculiar also to the sandy plains, while the cold, damp, rocky hillsides are adapted to the hemlock, canoe birch and beech, though other trees monopolize this soil to-day. The borders of the meadow give rise to the alder, witch hazel, ironwood and red maple. The variety of loamy soil furnishes an environment for the pine, chestnut and oak, and the swamps contain the black spruce, hackmatack, white cedar, and occasionally, the arbor vitae.

The principal forest trees at present are the pine, chestnut, oak, birch, maple, alder, poplar, willow, ironwood, hickory, hemlock, ash, cedar, spruce, beech. Their predominance follows quite closely after the order named. This order is not, however, the same as that which occurred in the primitive forests. The hemlock, beech and canoe birch have decreased and other species have taken their places. The pine was always, and is to-day, a valuable and prominent tree in this region, and undoubtedly is holding its own. The amount of young pines now

in central Massachusetts is considerable. There is, in fact, no tree which takes so readily to the old and neglected pastures, as does the pine, and they are gradually becoming filled with this species. This is a most fortunate occurrence, as these old pastures are practically worthless for other purposes, and it is by this means that the pine holds its own so readily, and compensates for that loss which occurs in consequence of rotation with hard wood where forests of this tree have been cleared. The chestnut propagates itself almost entirely by sprouts, hence the old term, "sprout lot." There is consequently no rotation which takes place in this species. The same old soil which produced chestnut for centuries is producing it to-day, and apparently with the same vigor. It is interesting to note that each successive growth of chestnut always springs from the same old stump and root system; from which it would appear that the same old root system, or at least offshoots of it, has been supporting chestnuts since the glacial period. In the clearing of so many of the clay hills in olden times the habitat of the chestnut was somewhat reduced, and notwithstanding the enormous quantity of seed produced every year by this tree, many of which escape the squirrel and small boy, comparatively few trees of this species originated from seed. The chestnut, therefore, is not so abundant as formerly, though it maintains a uniform distribution.

The oak occurs with the chestnut and undoubtedly is as abundant as ever. This tree is placed third in the list, but in the old primitive forests, I am inclined to believe that the hemlock would fill this place. At the present time, however, it is a considerably rarer tree. No tree in central Massachusetts has fallen behind like the hemlock. When forests of this tree are cut one seldom finds a second growth of any pretension, and a third growth is even more rare. I believe it is within the bounds of accuracy to state that the hemlock has fallen off over eighty-five per cent. This is not from the lack of seed production, but from the fact that the seedlings do not find the proper conditions for thriving. It is a well-known fact that the hemlock seedling requires shade, and when forests of these trees are cut, they do not furnish the proper conditions for this development. As the hemlock, however, has decreased, the white birch and poplar have increased, but they, at present, possess little commercial value. In the old forests the conditions were such that they were more scattered, being confined to openings and to the borders of woods, but now they form large groups in themselves.

The alder, ironwood, red maple and hazel, border the meadows and

streams as of old, and are perhaps slightly more abundant than formerly, as now they have a greater latitude of growth. The hickory, ash, white maple, rock maple and hop-hornbean have not changed materially; the latter, however, is not abundant, and very likely never has been. The elm, which is quite abundant, and the sycamore, which is less so, retain their old habitats along the river valleys, and the white cedar, hackmatack and black spruce have shared with one another the absolute monopoly of the swamps for centuries. Excepting for the flooding of so many of the swamps for artificial ponds, these species remain precisely the same. The beech and canoe birch have both fallen off; the beech more especially, as this tree does not seed very abundantly here, and, by the present methods of deforestation, the soil conditions are rendered unfit for the development of this species.

Briefly stated, then, we may say that the principal changes which have taken place in the forests of central Massachusetts are these: The hemlock, beech and canoe birch have become less abundant, while the quicker growing white birch and poplar have become more abundant. The complete and continual removal of the forest growths has undoubtedly exerted a great influence upon many of our smaller plants.

One of the principal causes of the decline of our smaller plants can be traced directly to the lack of organic matter, or humus, in the soil. The methods of deforestation which have been employed for so many years are the cause of this. These methods consist in clearing vast areas of land of the trees — usually burning them over and subjecting them for a year or so to the scorching rays of the sun. By this process, the conditions of the soil undergo remarkable changes, and entirely different environmental conditions result. Very frequently the regions of cleared forest are utilized for pasture; then, after some years, they are again allowed to grow up to forests. But whatever use is made of the deforested areas, the results are practically the same; namely, the organic matter, or humus, and the water conditions are entirely changed, which results in unfitting the soil for many plants.

The former luxuriance of our meadow grasses, and strawberries, and such humus loving plants as our orchids, can at the present time be imagined by catching glimpses of them growing under virgin soil conditions. The humus loving plants growing about Mt. Toby, Mt. Holyoke, and on the Berkshire Mountains where the forests are more like the primitive conditions, are generally twice or three times

the size of those found in the too frequently deforested and thickly populated region of the eastern part of the state. There is no plant, however, which shows such a decline in Massachusetts as the strawberry,¹ and this is within the memory of men now living. Among other plants which possess much less limited habitats are *Habenaria Hookeri* and *H. orbiculata*, which thrive best in old pine woods; and *Orchis spectabilis*, *Cypripedium parviflorum* and *C. pubescens* do not find the requisite conditions for their growth and luxuriant development after successive deforestation, while species like *Habenaria ciliaris*, which possess an extremely limited habitat, have to my own knowledge become already exterminated in certain localities, owing to deforestation. So would the beech drops become less abundant with the decline of the beech, as this only grows parasitically upon its roots. And then there are hosts of plants, such as the Aralias, numerous species of Fungi, Mosses and Liverworts, which once thrived more abundantly and luxuriantly than at the present day. On the other hand, there are many plants such as the blackberry, raspberry, and checkerberry which grow more abundantly and luxuriantly after the first removal of the virgin forest, although these have undoubtedly declined, on account of the diminished organic matter in the soil.

In closing, however, it may be mentioned that the mere increase of certain species and decline of others, does not convey to us an adequate conception as to the difference in the external configuration which has taken place in our forest growths. In the decline of the hemlock, one of the most potent factors in the production of picturesque scenery has disappeared. Old forest growths of these somber trees resembled the "misty darkness of a cavern" and added much to the beauty of our pellucid streams. The original size of the forest trees was also an important factor in the make-up of the primitive forests. The pine at the present day is seldom seen with a diameter of over eighteen inches, whereas, in the old forests, specimens could be found six feet in diameter and two hundred and fifty feet high. The canoe birch trees could be found growing three feet in diameter, but to-day they rarely escape the axe after they have attained the thickness of eight or ten inches. The majority of pitch pines at present have a height of about twenty-five feet and a diameter of about fourteen inches, but I have seen individual specimens of mature old growth — 150 years old — which were eighty feet high and two feet in diameter.

¹ See Garden and Forest, ix. 82 (1896).

Growths of chestnut 150 years old, have a diameter of about twenty inches when growing singly, while in open places they frequently attain a diameter of three feet in sixty years, and sometimes grow very much larger than this. Chestnut, however, is usually cut for railroad ties when fifty or sixty years old, and about fourteen inches through, although this tree and the oak more often escape the woodman than does the pine.

In considering the changes which have taken place, the question naturally arises, whether if the forests were left undisturbed they would return to their former condition. Undoubtedly this would eventually take place, but it would require more than three hundred years for the hemlock to regain its former habitat. The decline of certain species and the increase of others is largely due to the ruthless methods of deforestation which have been in vogue here from the very beginning. Were a scientific or rational system of forestry maintained, the forest growth would not undergo such abrupt changes, but would tend to conform more to its primitive condition, and the entire floral condition would resemble quite closely that of old. From an economic point of view, the decline of the hemlock, and the increase of the birch and poplar is probably of not much importance. The most valuable trees, the pine and chestnut, are still common, and undoubtedly will remain so. However, there are still many hundred acres of old pasture that might be more profitably occupied by pine forests.

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A NEW GRIMMIA FROM MT. WASHINGTON.

E. G. BRITTON.

(Plate 7.)

Grimmia Evansi, SPEC. NOV. Plants forming low, dense, dirty tufts of a dark green or yellowish brown color, only the uppermost ends of the branches being green and free from gravel. Stems about 15mm. high with short fastigiate branches 5mm. long, naked and radiculose below, crowded above with spreading leaves which are about 1mm. long by 0.5–0.7 mm. broad, oblong, concave, acute or apiculate with inrolled margins above forming a more or less cucullate apex, the stout vein ending in or just below the point which occasionally is formed by a single short hyaline cell; apical cells rounded and indistinct, slightly sinuous, composed more or less of two irregular layers of